

CLAIMS

What is claimed is:

1. An pharmaceutical composition comprising a SMIP compound of formula (I):

X-Y-Z (I)

wherein,

X is selected from the group consisting of substituted or unsubstituted alkyl, aryl, heteroaryl, fused arylaryl, fused heteroarylaryl, fused heteroarylheteroaryl, unfused arylaryl, unfused heteroarylaryl, unfused heteroarylheteroaryl and heterocyclyl groups;

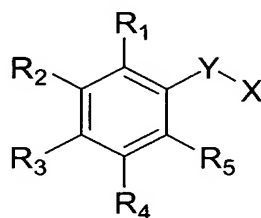
Y is a linking moiety; and,

Z is selected from the group consisting of substituted or unsubstituted aryl, heteroaryl, fused arylaryl, fused heteroarylaryl, and fused arylheteroaryl,

or a pharmaceutically acceptable salt, ester, or prodrug thereof and a pharmaceutically acceptable excipient wherein said composition elicits an immune response in a subject.

2. The composition of claim 1 wherein Y is a covalent bond or a linking moiety selected from the group consisting of -CO-, -O-, -S-, -CH₂-, and -NH-.

3. The composition of claim 1 wherein the SMIP compound is compound of formula (II):



II

wherein,

Y is absent or a linking moiety;

X is selected from the group consisting of substituted or unsubstituted alkyl, aryl, heteroaryl, fused arylaryl, fused heteroarylaryl, fused heteroarylheteroaryl, unfused arylaryl, unfused heteroarylaryl, unfused heteroarylheteroaryl and heterocyclyl groups;

R₁ is selected from the group consisting of H, halogen, hydroxy, amino, nitro, cyano, carboxylic acid, and substituted or unsubstituted alkyl, alkenyl, alkynyl alkylamino, aminoalkyl, alkylcarbonyloxy, alkoxycarbonyl, aminocarbonyl, alkylaminocarbonyl, carbonylamino, alkylcarbonylamino, alkoxy, alkoxyalkyl, carbocyclyl, heterocyclyl, aryl, heteroaryl, fused arylaryl, unfused arylaryl fused heteroarylaryl, unfused heteroarylaryl, fused arylheteroaryl and unfused arylheteroaryl groups;

R₂ is selected from the group consisting of H, halogen, hydroxy, amino, nitro, cyano, carboxylic acid, and substituted or unsubstituted alkyl, alkenyl, alkynyl alkylamino, aminoalkyl, alkylcarbonyloxy, alkoxycarbonyl, aminocarbonyl, alkylaminocarbonyl, carbonylamino, alkylcarbonylamino, alkoxy, alkoxyalkyl, carbocyclyl, heterocyclyl, aryl, heteroaryl, fused arylaryl, unfused arylaryl fused heteroarylaryl, unfused heteroarylaryl, fused arylheteroaryl and unfused arylheteroaryl groups; or,

R₂ is taken together with R₃ to form a substituted or unsubstituted 5-7 membered ring consisting of all carbon atoms or 1-2 heteroatoms selected from the group consisting of O, S, N; or,

R₃ is selected from the group consisting of H, halogen, hydroxy, amino, nitro, cyano, carboxylic acid, and substituted or unsubstituted alkyl, alkenyl, alkynyl alkylamino, aminoalkyl, alkylcarbonyloxy, alkoxycarbonyl, aminocarbonyl, alkylaminocarbonyl, carbonylamino, alkylcarbonylamino, alkoxy, alkoxyalkyl, carbocyclyl, heterocyclyl, aryl, heteroaryl, fused arylaryl, unfused arylaryl fused heteroarylaryl, unfused heteroarylaryl, fused arylheteroaryl and unfused arylheteroaryl groups;

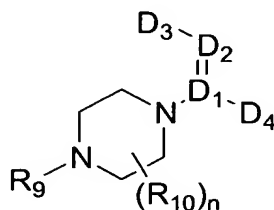
R₄ is selected from the group consisting of H, halogen, hydroxy, amino, nitro, cyano, carboxylic acid, and substituted or unsubstituted alkyl, alkenyl, alkynyl alkylamino, aminoalkyl, alkylcarbonyloxy, alkoxycarbonyl, aminocarbonyl, alkylaminocarbonyl, carbonylamino, alkylcarbonylamino, alkoxy, alkoxyalkyl, carbocyclyl, heterocyclyl, aryl, heteroaryl, fused arylaryl,

unfused arylaryl fused heteroarylaryl, unfused heteroarylaryl, fused arylheteroaryl and unfused arylheteroaryl groups; and
 R_5 is selected from the group consisting of H, halogen, hydroxy, amino, nitro, cyano, carboxylic acid, and substituted or unsubstituted alkyl, alkenyl, alkynyl, alkylamino, aminoalkyl, alkylcarbonyloxy, alkoxy carbonyl, aminocarbonyl, alkylaminocarbonyl, carbonylamino, alkylcarbonylamino, alkoxy, alkoxyalkyl, carbocyclyl, heterocyclyl, aryl, heteroaryl, fused arylaryl, unfused arylaryl fused heteroarylaryl, unfused heteroarylaryl, fused arylheteroaryl and unfused arylheteroaryl groups,
 or a pharmaceutically acceptable salt, ester, or prodrug thereof.

4. The composition of claim 3 wherein Y is a linking moiety is selected from the group consisting of -CO-, -O-, -S-, -CH₂-, -NH-; with the proviso that an aminocarbonyl group is not formed between the attachment of Y and X.

5. The composition of claim 1 wherein the SMIP compound is selected from the group consisting of an acylpiperazine, an indoleione, a tetrahydroisoquinoline, a benzocyclodione, an amino azavinyl compound, a thiosemicarbazone, a lactam, an aminobenzimidazole quinolinone, a hydrophthalamide, a benzophenone, an isoxazole, a sterol, a quinazolinone, a pyrrole, an anthraquinone, a quinoxaline, a triazine, an benzazole, and a pyrazolopyrimidine, or a pharmaceutically acceptable salt, ester, or prodrug thereof.

6. The composition of claim 1 wherein the SMIP compound is an acylpiperazine compound of formula (III):



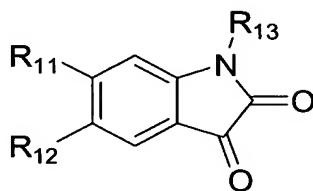
III

wherein,

R_9 is selected from the group consisting of substituted or unsubstituted aryl, heteroaryl, arylalkyl, arylalkenyl, heteroarylalkyl, and heteroarylalkenyl;

R_{10} is substituted or unsubstituted alkyl;
 n is an integer from 0-2; and
 if D_1 is carbon then D_2 is oxygen, D_3 is absent, and D_4 is selected from the group consisting of substituted or unsubstituted aryl, heteroaryl, carbocycl, alkoxyaryl, fused arylaryl, fused arylheteroaryl, and fused heteroarylaryl; or,
 if D_1 is nitrogen then D_2 is nitrogen, D_4 is absent, and D_3 is selected from the group consisting of substituted or unsubstituted aryl, heteroaryl, carbocycl, alkoxyaryl, fused arylaryl, fused arylheteroaryl, and fused heteroarylaryl,
 or a pharmaceutically acceptable salt, ester, or prodrug thereof.

7. The composition of claim 1 wherein the SMIP compound is an indoledione compound of formula (IV):



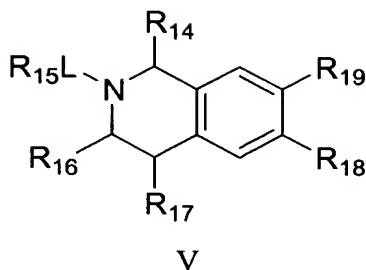
IV

wherein,

R_{11} and R_{12} are independently selected from the group consisting of H, nitro, halogen, amino, hydroxy, cyano, carboxylic acid, and substituted or unsubstituted alkyl, aryl, heteroaryl, alkoxy, alkylcarbonyl, alkylcarbonylamino, alkylaminocarbonyl, aminocarbonyl, arylalkoxy, heteroarylalkoxy, alkylamino, arylalkylamino, arylamino, heteroarylamino, heteroarylaminomethyl, heterocycl, heterocyclalkoxy, heterocyclalkyl, and carbocycl;

R_{13} is selected from the group consisting of substituted or unsubstituted aryl, heteroaryl, arylalkyl, heteroarylalkyl, heterocycl, heterocyclalkyl, and alkylbenzyl, or a pharmaceutically acceptable salt, ester, or prodrug thereof.

8. The composition of claim 1 wherein the SMIP compound is a tetrahydroisoquinoline compound is a compound of Formula (V):



wherein,

L is a covalent bond or selected from the group consisting of -CH₂-, -CO-, -O-, -S-, CHF, -NH-, -NR₂₀-, where R₂₀ is lower alkyl;

R₁₄ is selected from the group consisting of hydrogen, halogen, and substituted or unsubstituted alkyl;

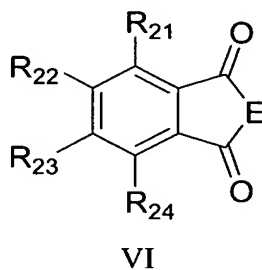
R₁₅ is selected from the group consisting of substituted or unsubstituted carbocyclyl, aryl, arylalkyl, alkoxyaryl, heteroaryl, heterocyclyl;

R₁₆ is selected from the group consisting of hydrogen, halogen, and substituted or unsubstituted alkyl;

R₁₇ is selected from the group consisting of hydrogen, halogen, and substituted or unsubstituted alkyl;

R₁₈ and R₁₉ are independently selected from the group consisting of H, hydroxy, halogen, alkoxy, amino, unsubstituted alkyl, substituted alkyl, and alkylamino, or a pharmaceutically acceptable salt, ester, or prodrug thereof.

9. The composition of claim 1 wherein the SMIP compound is a benzocyclodione compound of formula (VI):



wherein,

E is selected from the group consisting of NR₂₅ or CR₂₆R₂₇;

R₂₁, R₂₃, and R₂₄ are independently selected from the group consisting of H, hydroxy, halogen, alkoxy, amino, unsubstituted alkyl, substituted alkyl, and alkylamino;

R₂₂ is selected from the group consisting of H, hydroxy, halogen, alkoxy, amino, and unsubstituted or substituted alkyl, and alkylamino, arylalkyl, heteroarylalkyl, aryl, heteroaryl, arylcarbonyl, heterocyclyl, heterocyclalkyl, and heteroarylcarbonyl;

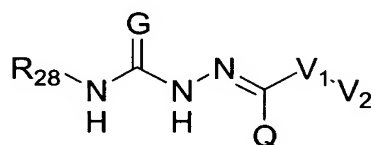
R₂₅ is selected from the group consisting of substituted or unsubstituted aryl, heteroaryl, heterocyclyl, carbocyclyl, arylalkyl, heteroarylalkyl, and heterocyclalkyl;

R₂₆ is selected from the group consisting of H, halogen, hydroxy, amino, and substituted or unsubstituted alkyl, carbonylalkyl, and alkylcarbonylalkyl;

R₂₇ is selected from the group aryl, arylalkyl, heteroarylalkyl, heterocyclyl, heterocyclalkyl, carbocyclyl, arylcarbonylalkyl, and arylalkylcarbonyl,

or a pharmaceutically acceptable salt, ester, or prodrug thereof.

10. The composition of claim 1 wherein the SMIP compound is an aminoazavinyl compound of formula (VII):



VII

wherein,

G is either S or NH;

R₂₈ is selected from the group consisting of H, and substituted or unsubstituted alkyl, aryl, heteroaryl, heteroarylalkyl, arylalkyl, carbocyclyl, carbocyclalkyl, heterocyclyl, and heterocyclalkyl;

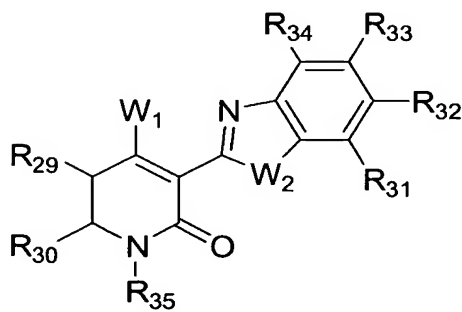
Q is selected from the group consisting of hydrogen, substituted alkyl, unsubstituted alkyl, and aryl, substituted aryl, heteroaryl, substituted heteroaryl, heterocyclyl, substituted heterocyclyl, biaryl, substituted biaryl, arylheteroaryl, substituted arylheteroaryl, heteroarylheteroaryl, and substituted heteroarylheteroaryl;

V₁ is selected from the group consisting of alkyl, substituted alkyl, aryl, substituted aryl, arylalkyl, substituted arylalkyl, heteroaryl, substituted heteroaryl, heteroarylalkyl, substituted heteroarylalkyl, alkoxy, substituted alkoxy, aminocarbonyl, alkoxycarbonyl, carboxyl sulfonyl, methanesulfonyl,

and substituted or unsubstituted alkylcarbonyl, arylcarbonyl, aralkylcarbonyl, heteroarylcarbonyl, heteroaralkylcarbonyl, alkylcarbonyloxy, arylcarbonyloxy, aralkylcarbonyloxy, heteroarylcarbonyloxy, heteroaralkylcarbonyloxy, alkylaminocarbonyloxy, arylaminocarbonyloxy, formyl, loweralkylcarbonyl, loweralkoxycarbonyl, aminocarbonyl, aminoaryl, alkylsulfonyl, sulfonamido, aminoalkoxy, alkylamino, heteroarylamino, alkylcarbonylamino, alkylaminocarbonylamino, arylaminocarbonylamino, aralkylcarbonylamino, heteroarylcarbonylamino, arylcarbonylamino, cycloamidino, cycloalkyl, cycloimido, arylsulfonyl and arylsulfonamido;

V₂ is selected from the group consisting of hydrogen, halogen, alkyl, substituted alkyl, aryl, substituted aryl, arylalkyl, substituted arylalkyl, heteroaryl, substituted heteroaryl, heteroarylalkyl, substituted heteroarylalkyl, alkoxy, substituted alkoxy, aminocarbonyl, alkoxycarbonyl, carboxyl sulfonyl, methanesulfonyl, and substituted or unsubstituted alkylcarbonyl, arylcarbonyl, aralkylcarbonyl, heteroarylcarbonyl, heteroaralkylcarbonyl, alkylcarbonyloxy, arylcarbonyloxy, aralkylcarbonyloxy, heteroarylcarbonyloxy, heteroaralkylcarbonyloxy, alkylaminocarbonyloxy, arylaminocarbonyloxy, formyl, loweralkylcarbonyl, loweralkoxycarbonyl, aminocarbonyl, aminoaryl, alkylsulfonyl, sulfonamido, aminoalkoxy, alkylamino, heteroarylamino, alkylcarbonylamino, alkylaminocarbonylamino, arylaminocarbonylamino, aralkylcarbonylamino, heteroarylcarbonylamino, arylcarbonylamino, cycloamidino, cycloalkyl, cycloimido, arylsulfonyl and arylsulfonamido, or a pharmaceutically acceptable salt, ester, or prodrug thereof.

11. The composition of claim 1 wherein the SMIP compound is an ABIQ compound of formula (VIII):



VIII

wherein,

W₁ is selected from the group consisting of -OH, -OR₃₆ groups, -NR₃₇R₃₈;

W₂ is selected from the group consisting of O, S, and NR₃₉ groups;

R₂₉ and R₃₀ join to form a 5 to 6 membered substituted or unsubstituted ring comprising all carbon atoms or at least one O, N, or S atom;

R₃₅ and R₃₉ may be the same or different and are selected from the group consisting of H, -OH substituted and unsubstituted alkyl groups, substituted and unsubstituted aryl groups, -C(=O)H, -C(=O)-alkyl groups, and -C(=O)-aryl groups;

R₃₁, R₃₂, R₃₃, and R₃₄ may be the same or different and are independently selected from the group consisting of H, Cl, Br, F, I, -NO₂, -CN, -OH, -OR₄₀ groups, -NR₄₁R₄₂ groups, -C(=O)R₄₃ groups, -SH groups, substituted and unsubstituted amidinyl groups, substituted and unsubstituted guanidinyl groups, substituted and unsubstituted alkyl groups, substituted and unsubstituted aryl groups, substituted and unsubstituted alkenyl groups, substituted and unsubstituted alkynyl groups, substituted and unsubstituted heterocyclyl groups, substituted and unsubstituted alkylaminoalkyl groups, substituted and unsubstituted dialkylaminoalkyl groups, substituted and unsubstituted arylaminoalkyl groups, substituted and unsubstituted diarylaminoalkyl groups, substituted and unsubstituted (alkyl)(aryl)aminoalkyl groups, substituted and unsubstituted heterocyclylalkyl groups, substituted and unsubstituted aminoalkyl groups, substituted and unsubstituted heterocyclylaminoalkyl groups, substituted and unsubstituted diheterocyclylaminoalkyl groups, substituted and unsubstituted (alkyl)(heterocyclyl)aminoalkyl groups, substituted and unsubstituted (aryl)(heterocyclyl)aminoalkyl groups, substituted and unsubstituted hydroxyalkyl groups, substituted and unsubstituted alkoxyalkyl groups, substituted and unsubstituted aryloxyalkyl groups, and substituted and unsubstituted heterocycloxyalkyl groups;

R₃₆ is selected from the group consisting of substituted and unsubstituted alkyl groups, substituted and unsubstituted aryl groups, substituted and unsubstituted heterocyclyl groups, substituted and unsubstituted heterocyclylalkyl groups, -C(=O)H, -C(=O)-alkyl groups, -C(=O)-aryl groups, -C(=O)O-alkyl groups, -C(=O)O-aryl groups, -C(=O)NH₂, -C(=O)NH(alkyl) groups, -C(=O)NH(aryl) groups, -C(=O)N(alkyl)₂ groups, -C(=O)N(aryl)₂

groups, -C(=O)N(alkyl)(aryl) groups, -NH₂, -NH(alkyl) groups, -NH(aryl) groups, -N(alkyl)₂ groups, -N(alkyl)(aryl) groups, -N(aryl)₂ groups, -C(=O)NH(heterocyclyl) groups, -C(=O)N(heterocyclyl)₂ groups, -C(=O)N(alkyl)(heterocyclyl) groups, and -C(=O)N(aryl)(heterocyclyl) groups;

R₃₇ is selected from the group consisting of H, substituted and unsubstituted alkyl groups, substituted and unsubstituted aryl groups, and substituted and unsubstituted heterocyclyl groups;

R₃₈ is selected from the group consisting of H, substituted and unsubstituted alkyl groups, substituted and unsubstituted aryl groups, substituted and unsubstituted heterocyclyl groups, -OH, alkoxy groups, aryloxy groups, -NH₂, substituted and unsubstituted heterocyclylalkyl groups, substituted and unsubstituted aminoalkyl groups, substituted and unsubstituted alkylaminoalkyl groups, substituted and unsubstituted dialkylaminoalkyl groups, substituted and unsubstituted arylaminoalkyl groups, substituted and unsubstituted diarylaminoalkyl groups, substituted and unsubstituted (alkyl)(aryl)aminoalkyl groups, substituted and unsubstituted alkylamino groups, substituted and unsubstituted arylamino groups, substituted and unsubstituted dialkylamino groups, substituted and unsubstituted diarylamino groups, substituted and unsubstituted (alkyl)(aryl)amino groups, -C(=O)H, -C(=O)-alkyl groups, -C(=O)-aryl groups, -C(=O)O-alkyl groups, -C(=O)O-aryl groups, -C(=O)NH₂, -C(=O)NH(alkyl) groups, -C(=O)NH(aryl) groups, -C(=O)N(alkyl)₂ groups, -C(=O)N(aryl)₂ groups, -C(=O)N(alkyl)(aryl) groups, -C(=O)-heterocyclyl groups, -C(=O)-O-heterocyclyl groups, -C(=O)NH(heterocyclyl) groups, -C(=O)-N(heterocyclyl)₂ groups, -C(=O)-N(alkyl)(heterocyclyl) groups, -C(=O)-N(aryl)(heterocyclyl) groups, substituted and unsubstituted heterocyclylaminoalkyl groups, substituted and unsubstituted diheterocyclylaminoalkyl groups, substituted and unsubstituted (alkyl)(heterocyclyl)aminoalkyl groups, substituted and unsubstituted (aryl)(heterocyclyl)aminoalkyl groups, substituted and unsubstituted hydroxyalkyl groups, substituted and unsubstituted alkoxyalkyl groups, substituted and unsubstituted aryloxyalkyl groups, and substituted and unsubstituted heterocycliloxyalkyl groups;

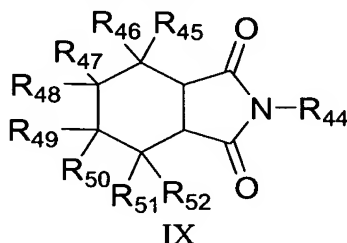
R₄₁ is selected from the group consisting of H, substituted and unsubstituted alkyl groups, substituted and unsubstituted aryl groups, and substituted and unsubstituted heterocyclyl groups;

R₄₂ is selected from the group consisting of H, substituted and unsubstituted alkyl groups, substituted and unsubstituted aryl groups, substituted and unsubstituted heterocyclyl groups, -C(=O)H, -C(=O)-alkyl groups, -C(=O)-aryl groups, -C(=O)NH₂, -C(=O)NH(alkyl) groups, -C(=O)NH(aryl) groups, -C(=O)N(alkyl)₂ groups, -C(=O)N(aryl)₂ groups, -C(=O)N(alkyl)(aryl) groups, -C(=O)O-alkyl groups, -C(=O)O-aryl groups, substituted and unsubstituted aminoalkyl groups, substituted and unsubstituted alkylaminoalkyl groups, substituted and unsubstituted dialkylaminoalkyl groups, substituted and unsubstituted arylaminoalkyl groups, substituted and unsubstituted diarylaminoalkyl groups, substituted and unsubstituted (alkyl)(aryl)aminoalkyl groups, substituted and unsubstituted heterocyclylalkyl groups, -C(=O)-heterocyclyl groups, -C(=O)-O-heterocyclyl groups, -C(=O)NH(heterocyclyl) groups, -C(=O)-N(heterocyclyl)₂ groups, -C(=O)-N(alkyl)(heterocyclyl) groups, -C(=O)-N(aryl)(heterocyclyl) groups, substituted and unsubstituted heterocyclylaminoalkyl groups, substituted and unsubstituted diheterocyclylaminoalkyl groups, substituted and unsubstituted (heterocyclyl)(alkyl)aminoalkyl groups, substituted and unsubstituted (heterocyclyl)(aryl)aminoalkyl groups, substituted and unsubstituted hydroxyalkyl groups, substituted and unsubstituted alkoxyalkyl groups, substituted and unsubstituted aryloxyalkyl groups, and substituted and unsubstituted heterocyclyloxyalkyl groups; and

R₄₃ is selected from the group consisting of H, -NH₂, -NH(alkyl) groups, -NH(aryl) groups, -N(alkyl)₂ groups, -N(aryl)₂ groups, -N(alkyl)(aryl) groups, -NH(heterocyclyl) groups, -N(heterocyclyl)(alkyl) groups, -N(heterocyclyl)(aryl) groups, -N(heterocyclyl)₂ groups, substituted and unsubstituted alkyl groups, substituted and unsubstituted aryl groups, -OH, substituted and unsubstituted alkoxy groups, substituted and unsubstituted heterocyclyl groups, substituted and unsubstituted aryloxy groups, heterocyclyloxy groups, -NHOH, -N(alkyl)OH groups, -N(aryl)OH groups, -N(alkyl)O-alkyl groups, -N(aryl)O-alkyl groups, -N(alkyl)O-aryl groups, and -

N(aryl)O-aryl groups, or a pharmaceutically acceptable salt, ester, or prodrug thereof.

12. The composition of claim 1 wherein the SMIP compound is an hydrophthalamide compound of formula (IX):



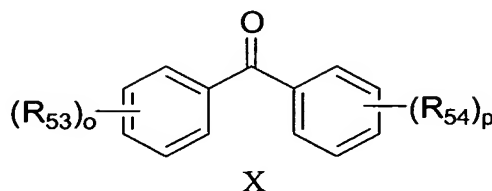
wherein,

R₄₄ is selected from the group consisting of substituted or unsubstituted aryl, heteroaryl, arylalkyl, heteroarylalkyl, fused arylaryl, unfused arylaryl, fused heteroarylaryl, unfused heteroarylaryl, fused arylheteroaryl, and unfused arylheteroaryl;

R₄₅, R₄₇, R₄₉, and R₅₁ may be the same or different and are independently selected from the group consisting of H, nitro, halogen, amino, hydroxy, cyano, carboxycyclic acid, and substituted or unsubstituted alkyl, aryl, heteroaryl, alkoxy, alkylcarbonyl, alkylcarbonylamino, alkylaminocarbonyl, aminocarbonyl, arylalkoxy, heteroarylalkoxy, alkylamino, arylalkylamino, arylamino, heteroarylamino, heteroarylaminomethyl, heterocyclyl, heterocyclylalkoxy, heterocyclylalkyl, and carbocyclyl; and

R₄₆, R₄₈, R₅₀, and R₅₂ may be the same or different and are independently selected from the group consisting of H, halogen, and substituted or unsubstituted alkyl groups, or a pharmaceutically acceptable salt, ester, or prodrug thereof.

13. The composition of claim 1 wherein the SMIP compound is a benzophenone compound of formula (X):



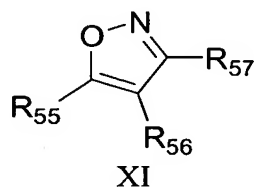
wherein,

R₅₃ is independently selected from the group consisting of H, nitro, halogen, amino, hydroxy, cyano, carboxycyclic acid, and substituted or unsubstituted alkyl, aryl, heteroaryl, alkoxy, alkylcarbonyl, alkylcarbonylamino, alkylaminocarbonyl, aminocarbonyl, arylalkoxy, heteroarylalkoxy, alkylamino, arylalkylamino, arylamino, heteroarylamino, heteroarylaminomethyl, heterocyclyl, heterocyclylalkoxy, heterocyclylalkyl, and carbocyclyl;

R₅₄ is independently selected from the group consisting of H, nitro, halogen, amino, hydroxy, cyano, carboxycyclic acid, and substituted or unsubstituted alkyl, aryl, heteroaryl, alkoxy, alkylcarbonyl, alkylcarbonylamino, alkylaminocarbonyl, aminocarbonyl, arylalkoxy, heteroarylalkoxy, alkylamino, arylalkylamino, arylamino, heteroarylamino, heteroarylaminomethyl, heterocyclyl, heterocyclylalkoxy, heterocyclylalkyl, and carbocyclyl; and

o and p are integers from 0-4, or a pharmaceutically acceptable salt, ester, or prodrug thereof.

14. The composition of claim 1 wherein the SMIP compound is an isoxazole compound of formula (XI):



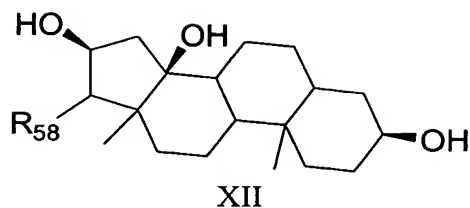
wherein,

R₅₅ is selected from the group consisting of substituted or unsubstituted aryl, arylalkyl, heteroaryl, heteroarylalkyl, heterocyclyl, and heterocyclylalkyl;

R₅₆ is selected from the group consisting of substituted or unsubstituted aryl, arylalkyl, heteroaryl, heteroarylalkyl, heterocyclyl, and heterocyclylalkyl;

R₅₇ is selected from the group consisting of H, halogen, hydroxy, and substituted or unsubstituted alkyl, aryl, heteroaryl, heterocyclyl, and carbonyl, or a pharmaceutically acceptable salt, ester, or prodrug thereof.

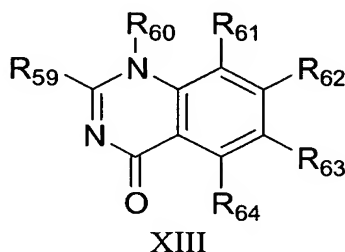
15. The composition of claim 1 wherein the SMIP compound is a sterol compound of formula (XII):



wherein,

R₅₈ is selected from the group consisting of substituted or unsubstituted aryl, arylalkyl, heteroaryl, heteroarylalkyl, heterocyclyl, and heterocyclylalkyl, or a pharmaceutically acceptable salt, ester, or prodrug thereof.

16. The composition of claim 1 wherein the SMIP compound is a quinazolinone compound of formula (XIII):



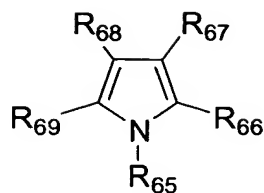
wherein,

R₅₉ is selected from the group consisting of H, halogen, hydroxy, and substituted or unsubstituted alkyl, aminoalkyl, alkylaminoalkyl, alkoxy, dialkylaminoalkyl, hydroxyalkyl, alkenyl, alkynyl, carbocyclyl, carbocyclylalkyl, heterocyclyl, and heterocyclylalkyl;

R₆₀ is selected from the group consisting of substituted or unsubstituted aryl, heteroaryl, arylalkyl, heteroarylalkyl, and heterocyclylalkyl; and,

R₆₁, R₆₂, R₆₃, and R₆₄ may be the same or different and are independently selected from the group consisting of H, nitro, halogen, amino, hydroxy, cyano, carboxylic acid, and substituted or unsubstituted alkyl, aryl, heteroaryl, alkoxy, alkylcarbonyl, alkylcarbonylamino, alkylaminocarbonyl, aminocarbonyl, arylalkoxy, heteroarylalkoxy, alkylamino, arylalkylamino, arylamino, heteroarylamino, heteroarylaminalkyl, heterocyclyl, heterocyclylalkoxy, heterocyclylalkyl, and carbocyclyl groups, or a pharmaceutically acceptable salt, ester, or prodrug thereof.

17. The composition of claim 1 wherein the SMIP compound is a pyrrole compound of formula (XIV):



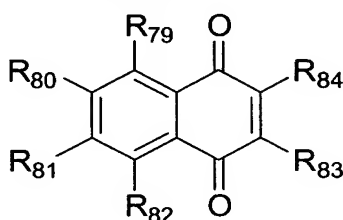
XIV

wherein,

R₆₅ is selected from the group consisting of H, hydroxy, and substituted or unsubstituted alkyl, aryl, heteroaryl, heteroarylalkyl, arylalkyl, heteroarylaminoalkyl, arylaminoalkyl, heteroaryloxyalkyl, and aryloxyalkyl groups;

R₆₆, R₆₇, R₆₈, and R₆₉ may be the same or different and are independently selected from the group consisting of H, nitro, halogen, amino, hydroxy, cyano, carboxylic acid, and substituted or unsubstituted alkyl, aryl, heteroaryl, alkoxy, alkylcarbonyl, alkylcarbonylamino, alkylaminocarbonyl, aminocarbonyl, arylalkoxy, heteroarylalkoxy, alkylamino, arylalkylamino, arylamino, heteroarylamino, heteroarylaminoalkyl, heterocyclyl, heterocyclylalkoxy, heterocyclylalkyl, and carbocyclyl groups, or a pharmaceutically acceptable salt, ester, or prodrug thereof.

18. The composition of claim 1 wherein the SMIP compound is an anthraquinone compound is a compound of Formula (XVI):



XVI

wherein,

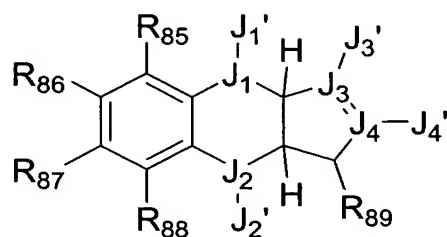
R₇₉, R₈₀, R₈₁, and R₈₂ may be the same or different and are independently selected from the group consisting of H, nitro, halogen, amino, hydroxy, cyano, carboxylic acid, and substituted or unsubstituted alkyl, aryl, heteroaryl, alkoxy, alkylcarbonyl, alkylcarbonylamino, sulfonyl, aminosulfonyl, alkylaminocarbonyl, aminocarbonyl, arylalkoxy,

heteroarylalkoxy, alkylamino, arylalkylamino, arylamino, heteroarylamino, heteroarylaminomethyl, heterocyclyl, heterocyclalkoxy, heterocyclalkyl, and carbocyclyl groups; and,

R₈₃ and R₈₄ are taken together to form a substituted or unsubstituted 5-6 membered ring containing all carbon atoms or 1-2 heteroatoms selected from the group consisting of O, S, and N,

or a pharmaceutically acceptable salt, ester, or prodrug thereof.

19. The composition of claim 1 wherein the SMIP compound is an quinoxaline compound of formula (XVII):



XVII

wherein,

J₁ is either C or N,

J₁' is selected from the group consisting of H, substituted aryl, unsubstituted aryl, substituted heteroaryl, and unsubstituted heteroaryl;

J₂ is either C or N,

J₂' is selected from the group consisting of H, substituted aryl, unsubstituted aryl, substituted heteroaryl, and unsubstituted heteroaryl;

J₃ is selected from the group consisting of -CO-, -NH-, and -N=;

if J₄ is -O- then J₄' is absent; or,

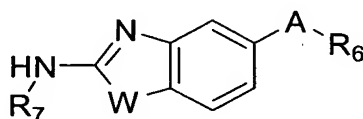
if J₄ is =C- then J₄' is selected from the group consisting of H and substituted or unsubstituted alkyl, alkoxy, aryl, heteroaryl, heteroarylalkyl, arylalkyl, aminoalkyl, alkylamino, and alkylthio groups; and,

R₈₅, R₈₆, R₈₇, R₈₈, and R₈₉ may be the same or different and are independently selected from the group consisting of H, nitro, halogen, amino, hydroxy, cyano, carboxylic acid, and substituted or unsubstituted alkyl, aryl, heteroaryl, alkoxy, alkylcarbonyl, alkylcarbonylamino, sulfonyl, aminosulfonyl, alkylaminocarbonyl, aminocarbonyl, arylalkoxy, heteroarylalkoxy, alkylamino, arylalkylamino, arylamino, heteroarylamino,

heteroarylaminoalkyl, heterocyclyl, heterocyclylalkoxy, heterocyclylalkyl, and carbocyclyl groups,
or a pharmaceutically acceptable salt, ester, or prodrug thereof.

20. The composition of claim 1 wherein the SMIP compound is a triazine compound, or a pharmaceutically acceptable salt, ester, or prodrug thereof.

21. The composition of claim 1 wherein the SMIP compound is a benzazole compound of formula (XXI):



XXI

wherein,

A is selected from the group consisting of -O-, -S-, -NH-, and -NR₈-;

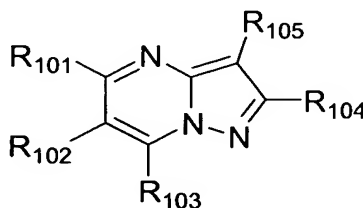
W is selected from the group consisting of -CH₂-, -O-, -S-, -NH-, and -NR₈-;

R₇ is selected from the group consisting of carbocyclyl, unfused carbocyclylcarbocyclyl, substituted aryl, unsubstituted aryl, substituted heteroaryl, unsubstituted heteroaryl, substituted fused arylheteroaryl, unsubstituted fused arylheteroaryl, substituted unfused arylaryl and unsubstituted unfused arylaryl;

R₆ is selected from the group consisting of substituted or unsubstituted aryl, and heteroaryl; and,

R₈ is independently substituted or unsubstituted alkyl,
or a pharmaceutically acceptable salt, ester, or prodrug thereof.

22. The composition of claim 1 wherein the SMIP compound is a pyrazalopyrimidine compound of formula (XXII):



XXII

wherein,

R₁₀₁ is selected from the group consisting of H, nitro, halogen, amino, hydroxy, cyano, carboxcyclic acid, and substituted or unsubstituted alkyl, aryl, heteroaryl, alkoxy, alkylcarbonyl, alkylcarbonylamino, sulfonyl, aminosulfonyl, alkylaminocarbonyl, aminocarbonyl, arylalkoxy, heteroarylalkoxy, alkylamino, arylalkylamino, arylamino, heteroarylamino, heteroarylaminomethyl, heterocyclyl, heterocyclylalkoxy, heterocyclylalkyl, and carbocyclyl groups;

R₁₀₂ is selected from the group consisting of H, nitro, halogen, amino, hydroxy, cyano, carboxcyclic acid, and substituted or unsubstituted alkyl, aryl, heteroaryl, alkoxy, alkylcarbonyl, alkylcarbonylamino, alkylaminocarbonyl, aminocarbonyl, arylalkoxy, heteroarylalkoxy, alkylamino, arylalkylamino, arylamino, heteroarylamino, heteroarylaminomethyl, heterocyclyl, heterocyclylalkoxy, heterocyclylalkyl, and carbocyclyl groups;

R₁₀₃ is selected from the group consisting of H, nitro, halogen, amino, hydroxy, cyano, carboxcyclic acid, trifluoromethyl, and substituted or unsubstituted alkyl, aryl, heteroaryl, alkoxy, alkylcarbonyl, alkylcarbonylamino, alkylaminocarbonyl, aminocarbonyl, arylalkoxy, heteroarylalkoxy, alkylamino, arylalkylamino, arylamino, heteroarylamino, heteroarylaminomethyl, heterocyclyl, heterocyclylalkoxy, heterocyclylalkyl, and carbocyclyl groups;

R₁₀₄ is selected from the group consisting of H and substituted or unsubstituted aryl, heteroaryl, arylalkoxy, heteroarylalkoxy, arylalkylamino, arylamino, heteroarylamino, heteroarylaminomethyl, heterocyclyl, heterocyclylalkoxy, heterocyclylalkyl, carbocyclylalkyl and carbocyclyl groups;

R₁₀₅ is selected from the group consisting of H and substituted or unsubstituted aryl, heteroaryl, arylalkoxy, heteroarylalkoxy, arylalkylamino, arylamino, heteroarylamino, heteroarylaminomethyl, heterocyclyl, heterocyclylalkoxy, heterocyclylalkyl, carbocyclylalkyl and carbocyclyl groups;

wherein at least one of R₁₀₄ and R₁₀₅ is not H,
or a pharmaceutically acceptable salt, ester, or prodrug thereof.

23. A pharmaceutical composition of one of claims 1-22, further comprising an antigen.

24. The pharmaceutical composition of claim 23 wherein the antigen is associated with a disease selected from the group consisting of BCG, cholera, plague, typhoid, hepatitis B infection, influenza, inactivated polio, rabies, measles, mumps, rubella, oral polio, yellow fever, tetanus, diphtheria, hemophilus influenzae b, meningococcus infection, and pneumococcus infection.

25. A method of stimulating an immune response in a subject comprising administering a pharmaceutical composition of one of claims 1-22.

26. The method of claim 25 wherein the immune response is the cellular production of one or more cytokines.

27. A method of treating asthma comprising administering to a patient in need thereof, an effective amount of a pharmaceutical composition from one of claims 1-22.

28. A method of vaccinating a subject comprising administering the pharmaceutical composition of one of claims 1-22 prior to, at the same time as, or after administration of a vaccine composition comprising an antigen.

29. A method of vaccinating a subject comprising administering the pharmaceutical composition of claim 23

30. The pharmaceutical composition of claim 1 wherein the SMIP compound is selected from the group consisting of:

N-methyl-4-[(2-{[2-(1-methylethyl)phenyl]amino}-1H-benzimidazol-5-yl)oxy]pyridine-2-carboxamide;

N-methyl-4-[[1-methyl-2-({3-[(trimethylsilyl)ethynyl]phenyl}amino)-1H-benzimidazol-5-yl]oxy]pyridine-2-carboxamide;

N-methyl-4-[(1-methyl-2-{[2-(phenylcarbonyl)phenyl]amino}-1H-benzimidazol-5-yl)oxy]pyridine-2-carboxamide;

4-(methyloxy)-N-[6-(methyloxy)-1,3-benzothiazol-2-yl]-3-nitrobenzamide;

4-({2-[(4-butylphenyl)amino]-1,3-benzothiazol-5-yl}oxy)-N-methylpyridine-2-carboxamide;

N-methyl-4-({1-methyl-2-[(6-pyrrolidin-1-ylpyridin-3-yl)amino]-1H-benzimidazol-5-yl}oxy)pyridine-2-carboxamide;

4-({2-[1,1'-bi(cyclohexyl)-2-ylamino]-1-methyl-1H-benzimidazol-5-yl}oxy)-N-methylpyridine-2-carboxamide;

4-({2-[(4-chlorophenyl)amino]-1-methyl-1H-benzimidazol-5-yl}oxy)-N-1,3-thiazol-2-ylpyridine-2-carboxamide;

4-[(1-methyl-2-{{2-(methyloxy)phenyl}amino}-1H-benzimidazol-5-yl)oxy]-N-[3-(methyloxy)propyl]pyridine-2-carboxamide; and,

4-({2-[(4-ethylphenyl)amino]-1,3-benzoxazol-5-yl}oxy)-N-methylpyridine-2-carboxamide.

31. The pharmaceutical composition of claim 1 wherein the SMIP compound is selected from the group consisting of:

5-chloro-1-{{3-(trifluoromethyl)phenyl}methyl}-1H-indole-2,3-dione;

1-[(4-methylphenyl)methyl]-5-nitro-1H-indole-2,3-dione;

5-chloro-1-{{3-(trifluoromethyl)phenyl}methyl}-1H-indole-2,3-dione;

1-methyl-6,7-bis(methyloxy)-2-{{3-(methyloxy)phenyl}carbonyl}-1,2,3,4-tetrahydroisoquinoline;

1-methyl-6,7-bis(methyloxy)-2-(naphthalen-2-ylcarbonyl)-1,2,3,4-tetrahydroisoquinoline; and,

[2-(trifluoromethyl)phenyl]methyl 3-[4-(aminocarbonyl)phenyl]-2-cycloheptyl-1-oxo-1,2,3,4-tetrahydroisoquinoline-4-carboxylate.

32. The pharmaceutical composition of claim 1 wherein the SMIP compound is selected from the group consisting of:

ethyl 4-{{5-[3,4-bis(methyloxy)phenyl]-7-(trifluoromethyl)pyrazolo[1,5-a]pyrimidin-3-yl}carbonyl}piperazine-1-carboxylate;

5-[3,4-bis(methyloxy)phenyl]-3-(piperidin-1-ylcarbonyl)-7-(trifluoromethyl)pyrazolo[1,5-a]pyrimidine;

5-[3,4-bis(methyloxy)phenyl]-N-methyl-N-(2-pyridin-2-ylethyl)-7-(trifluoromethyl)pyrazolo[1,5-a]pyrimidine-2-carboxamide;

5-propyl-2-thien-2-ylpyrazolo[1,5-a]pyrimidin-7-ol;

anthra[1,2-c][1,2,5]thiadiazole-6,11-dione;

benzo[b]oxanthrene-6,11-dione;

ethyl 6,11-dioxo-6,11-dihydrobenzo[b]phenazine-2-carboxylate;

N,N-dimethyl-9,10-dioxo-9,10-dihydroanthracene-1-sulfonamide; and,

2-(trifluoromethyl)-3-{{3,4,5-tris(methyloxy)phenyl}carbonyl}naphtho[2,3-b]furan-4,9-dione.

33. The pharmaceutical composition of claim 1 wherein the SMIP compound is selected from the group consisting of:

2-(2-oxopropyl)-2-phenyl-1H-indene-1,3(2H)-dione;

5,6-dichloro-2-[2-chloro-5-(trifluoromethyl)phenyl]-1H-isoindole-1,3(2H)-dione;

ethyl 4-{5-[(3-nitrophenyl)carbonyl]-1,3-dioxo-1,3-dihydro-2H-isoindol-2-yl}benzoate;

5,6-dichloro-2-[2-chloro-5-(trifluoromethyl)phenyl]-1H-isoindole-1,3(2H)-dione;

2-(4-amino-2-oxo-1-propyl-1,2-dihydroquinolin-3-yl)-1H-benzimidazole-6-carbonitrile;

4-amino-6-fluoro-7-({[4-(methyloxy)phenyl]methyl}amino)-3-[5-(4-methylpiperazin-1-yl)-1H-benzimidazol-2-yl]quinolin-2(1H)-one;

6-chloro-3-(5-chloro-1H-benzimidazol-2-yl)-4-{{2-(dimethylamino)ethyl}amino}quinolin-2(1H)-one; and,

4-amino-5-(1H-benzimidazol-2-yl)-1-methyl-1,7-dihydro-6H-pyrazolo[3,4-b]pyridin-6-one.

34. The pharmaceutical composition of claim 1 wherein the SMIP compound is selected from the group consisting of:

3-bromo-4-{{[(2-fluorophenyl)methyl]oxy}-5-(methyloxy)benzaldehyde thiosemicarbazone;

2-[4-(3-chlorophenyl)piperazin-1-yl]-5-nitrobenzaldehyde thiosemicarbazone;

4-{{[2-(3-chlorophenyl)ethyl]amino}-3-nitrobenzaldehyde thiosemicarbazone;
(1E)-6,9-dimethyl-2,3,4,9-tetrahydro-1H-carbazol-1-one thiosemicarbazone;
(2E)-1,1'-bi(cyclohexan)-1-en-2-one thiosemicarbazone;
4-{{[2-(4-chlorophenyl)ethyl]amino}-3-nitrobenzaldehyde thiosemicarbazone;
4-(diethylamino)-2-{{[(4-fluorophenyl)methyl]oxy}benzaldehyde N-(2-piperidin-1-ylethyl)thiosemicarbazone;
3,4-bis(methyloxy)benzaldehyde (1,1-dioxido-1,2-benzisothiazol-3-yl)(methyl)hydrazone; and,
(2E)-2-[(4-chlorophenyl)(5-chlorothiophen-2-yl)methylidene]hydrazine carboximidamide.

35. The pharmaceutical composition of claim 1 wherein the SMIP compound is selected from the group consisting of:

5,5-dimethyl-4-methylidene-3-(2,4,6-trinitrophenyl)-1,3-oxazolidin-2-one;
5-methyl-2-[4-(methyloxy)phenyl]hexahydro-1H-isoindole-1,3(2H)-dione;
5-methyl-2-(4-methylphenyl)hexahydro-1H-isoindole-1,3(2H)-dione;
N~2~-(4-chlorophenyl)-6,6-dimethyl-1,6-dihydro-1,3,5-triazine-2,4-diamine;
(7Z)-7-(furan-2-ylmethylidene)-3-phenyl-3,4-dihydro-2H-[1,3]thiazolo[3,2-a][1,3,5]triazin-6(7H)-one;
(3aR,9R,9aR)-6,7-dihydroxy-9-[3,4,5-tris(methyloxy)phenyl]-3a,4,9,9a-tetrahydronaphtho[2,3-c]furan-1(3H)-one;
6-chloro-2-(ethyloxy)-4-methyl-3-(4-nitrophenyl)-3a,4,9,9a-tetrahydro-3H-pyrrolo[2,3-b]quinoxaline;
ethyl 2-(ethyloxy)-4-methyl-3a,4,9,9a-tetrahydro-3H-pyrrolo[2,3-b]quinoxaline-3-carboxylate;
ethyl 4-({[2,5-bis(methyloxy)phenyl]amino}methyl)-3,5-dimethyl-1H-pyrrole-2-carboxylate;
1-{3-[(6-amino-5-nitropyridin-2-yl)amino]propyl}-4-(2-chlorophenyl)-N-[(2S)-2-hydroxypropyl]-1H-pyrrole-3-carboxamide;
(4-methylphenyl)(5-nitro-2-piperidin-1-ylphenyl)methanone;
(2S,5R)-N~1~-(4-methylphenyl)-5-phenyl-N~2~-(2-pyridin-2-ylethyl)pyrrolidine-1,2-dicarboxamide;

2-[(3S)-3-(acetylamino)-2-oxopyrrolidin-1-yl]-N-[2-(4-fluorophenyl)ethyl]acetamide;

N-[2-(2,4-dichlorophenyl)ethyl]-4-({(Z)-[(4,4-difluorocyclohexyl)imino][(3S)-3-methylpiperazin-1-yl)methyl}amino)benzamide;

4-[4-(methyloxy)phenyl]-5-phenylisoxazole;

methyl 4-{[4-(1-methylethyl)-2,3-dioxo-7-(trifluoromethyl)-3,4-dihydroquinoxalin-1(2H)-yl)methyl}benzoate;

(3beta,16beta)-3,14,16-trihydroxybufa-20,22-dienolide; and,

2-(aminomethyl)-1-(2-pyridin-2-ylethyl)quinazolin-4(1H)-one.